

U.S. Patent Application Serial No. **09/926,160**
Response filed November 22, 2004
Reply to OA dated August 10, 2004

REMARKS

Claims 1 and 5-8 are pending in this application. An amendment to claim 1 is presented in order to more particularly point out, and distinctly claim the subject matter to which the applicants regard as their invention. The applicants respectfully submit that no new matter has been added. Entry of the amendment is respectfully requested. It is believed that this Amendment is fully responsive to the Office Action dated **August 10, 2004**.

Support for the amendment to claim 1 may be found on page 8 of the specification, lines 4 to 3 from the bottom of the page.

Claims 1 and 5-8 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. 6,316,089 to Ohtani et al. in view of U.S. 5,847,036 to Takabatake et al. as set forth in section 4 of previous Office action. (Office action paragraph no. 2)

The rejection is overcome by the amendment to claim 1. In the amendment, the polymer (b) has been limited such that "the particle diameter of the polymer (b) is 300 to 5000 Angstroms (Å)." Applicant submits that this limitation is not taught or suggested by the cited references, the teachings of which are discussed below.

Regarding Ohtani et al. (US 6,316,089)

To illustrate the difference between the present invention and Ohtani et al., the following table compares the present invention and Example 2 of Ohtani et al.

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The Present Invention	Ohtani 's Example 2
(e) unsaturated polyester, vinyl ester	unsaturated polyester (Rigolac FK-2000)
(a) acrylic type polymerizable monomer, SP-8.1 to 10.0	styrene monomer (column 10, lines 20 to 27)
(b) High molecular weight polymer having a weight average molecular weight of 100,000 or more and that can be obtained in powdered form, consisting mainly of either polymethyl methacrylate or methyl methacrylate and which dissolves or swells, (a) the content is 10 to 50 parts by weight relative to 100 parts by weight of the monomer and <u>the particle diameter of the polymer is 300 to 5000 Angstroms</u>	visible light absorbing dye 0.03 parts organic quaternary boron compound (BP3B) 0.12 parts low-shrinkage agent (such as the example polymethyl methacrylate)
(c) photocuring agent	photocuring agent (visible light polymerization initiator I-1800) 1.0 part
(d) fibrous reinforcement photocurable sheet-form material	fibrous reinforcement photocurable prepregnated sheet

Ohtani et al. (column 22, line 15) discloses polymethyl methacrylate as an example of a low-shrinkage material that may be contained in the composition. Ohtani, in column 22, lines 19 to 23, discloses: "Amounts in excess of 40 parts by weight results in degraded moldability due to excessively high viscosity, and in addition, decreases in smoothness of the surface of the cured product and in heat resistance." On the other hand, in the present invention, polymer (b) is added to increase the viscosity, which is a different purpose than acting as a low-shrinkage agent.

A polymethyl methacrylate used as a low-shrinkage agent is normally polymerized by the **suspension polymerization method**. This point is widely known, as supported by a definition of

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“suspension polymerization” from a chemical dictionary (*Dictionary of Chemistry 3*) listing the example of polymerization of polymethyl methacrylate. (See attached copy of reference.)

The present specification, on page 8, lines 9 to 3 from the bottom, discloses that polymer (b) of the present application is usually produced in an emulsion form by **an emulsion polymerization method**, with the emulsions having a particle diameter ranging from 300 to 5000 Å (30 to 500 μ m). As disclosed on page 9 of the specification, lines 2 to 4, during drying, the particle diameter ranges from 20 to 100 μ m even when aggregated, being understood to be the particle diameter in the emulsion polymer.

In the present amendment to claim 1, the particle diameter is limited to 300 to 5000 Å, thereby distinguishing from Ohtani et al. The polymethyl methacrylate of Ohtani et al. is an ordinary one, and therefore would be obtained by **suspension** polymerization. Such a polymethyl methacrylate has a particle diameter of 1 mm or more, and there would be no overlap of the size of Ohtani’s polymer with the claimed range for polymer (b).

Also, Ohtani et al. discloses that thickening is performed by prepolymerization with a specified visible light absorbing dye and visible light polymerization initiator (column 5, lines 6 to 17), while in the present application viscosity increases by swelling and dissolving of the polymer (b). Since the present invention does not involve photopolymerization as in Ohtani et al., it has the advantage of thickening being easy to control.

Further, Ohtani et al., in column 10, lines 20 to 27, makes no disclosure of the use of “an acrylic type polymerizable monomer with an SP of 8.1 to 10.0” as recited in claim 1. In fact, there

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appears to be no mention of the SP value, and therefore no teaching or suggestion for any value for this parameter.

Moreover, Ohtani et al., in column 10, lines 4-5, lists only a styrene monomer as the possible polymerizable monomer. Example 1 of Ohtani et al. discloses a nonstyrenic resin but is unclear about the monomer. The present rejection is based on substitution of the “styrene monomer serving as reactive diluent” in Ohtani et al. by an acrylic type monomer, but Applicant submits that there is no clear suggestion in the reference for this substitution.

Regarding Takabatake et al. (US 5,847,036)

Takabatake et al. relates to an acrylic molding material with aluminum hydroxide blended as a filler in a resin composition called an acrylic syrup (comprising an acrylic polymer and acrylic monomer).

Accordingly, Takabatake’s invention differs in particle diameter from polymer (b), “a polymer which is either polymethyl methacrylate or a polymer consisting mainly of methyl methacrylate units ... produced in a powdered form having a weight average molecular weight of 100,000 or more, and wherein the particle diameter of the polymer (b) is 300 to 5000 Angstroms (Å)” of claim 1, as amended.

Takabatake et al. (column 4, lines 27 to 34) discloses that “bulk polymerization is preferable due to the good thickening condition of the resulting molding material”; that is, the (meth)acrylic polymer of Takabatake et al. is produced by **bulk polymerization**. It is common technical

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knowledge that **the polymer of the present invention having a particle diameter of 300 to 5000 Angstroms cannot be obtained** by the manufacturing method of Takabatake et al.

Applicant notes that Takabatake et al.'s polymer is not an unsaturated polyester resin, which is one of the possible components (e) of the present invention, in addition to differing from polymer (b) of the present invention.

Moreover, Takabatake et al. does not disclose that the polymer works as a thickener when producing a molding material.

Therefore, Takabatake et al. does not disclose or suggest a component consistent with polymer (b) of the present invention. Moreover, regarding a photocurable sheet, Takabatake et al. makes no disclosure or suggestion in relation to the SP value of (a).

Regarding the combination of Ohtani et al. and Takabatake et al.

As noted above, neither Ohtani et al. nor Takabatake et al. discloses the limitations of polymer (b) of claim 1, as amended. In addition, neither reference discloses or suggests the SP value recited in claim 1, and Applicant has noted that the Ohtani does not appear to suggest that the styrenic monomer as reactive diluent be substituted by an acrylic monomer.

In addition to these points, Applicant notes that the object of the present invention is to "provide a sheet-form material which is excellent in productivity, handleability and photocurability," an object not disclosed in Ohtani et al. and Takabatake et al.

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In light of the above differences, Applicant submits that a photocurable sheet such as that of the present invention which is excellent in productivity, handleability and photocurability could not be obtained even by combining the teachings of Takabatake et al. with those of Ohtani et al..

Applicant therefore submits that the present claims, as amended, are novel and non-obvious over Ohtani et al. and Takabatake et al., taken separately or in combination. Entry of the amendment and reconsideration of the rejection are respectfully requested.

In view of the aforementioned amendments and accompanying remarks, claims 1 and 5-8, as amended, are in condition for allowance, which action, at an early date, is requested.

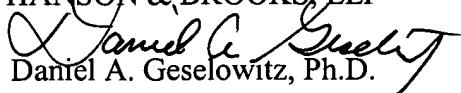
If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

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In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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PATENT TRADEMARK OFFICE

Enclosure: Copy of "Dictionary of Chemistry 3"; Dictionary of chemistry editorial committee, publ. Kyoritsu Shuppan Co., Ltd., pp. 456-457 with partial translation.
Petition for Extension of Time

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An English Translation of Reference

Dictionary of Chemistry 3

Editor: Dictionary of chemistry editorial committee

Publisher: Kyoritsu Shuppan Co., Ltd.

Suspension polymerization: A polymerization method in which a monomer is dispersed in a medium (mainly water) that does not dissolve the monomer at all or hardly dissolves it and, using a polymerization initiator that is hardly soluble in the medium and easily soluble in the monomer, a polymerization reaction is initiated within small droplets of the suspended monomer. The polymerization takes place in the shape of the dispersed droplets, with the eventual polymer often obtained as beautifully transparent particles or pearl shaped, leading to this polymerization method also being called particulate polymerization or pearl polymerization. The monomer is dispersed by mixing in water and an ordinary dispersion stabilizer or auxiliary stabilizer is added. In emulsion polymerization, various processes such as salting out, cleaning, dehydration and the like are required when removing a polymer from a polymer latex. However, in suspension polymerization, the polymer particles sink when mixing is stopped, simplifying the separation operation. A highly stable polymer is obtained with only small impurities in the generated polymer, making fabrication also easy. The size of the obtained polymer particles is inversely proportional to the mixing speed. Stabilizers are broadly classified into water soluble polymers and hardly soluble, finely powdered inorganic compounds. The former include gelatin, tragacanth gum, starch, methyl-cellulose, carboxymethylcellulose, polyvinyl alcohol, polyacrylate, while the latter include barium sulfate, calcium sulfate, barium carbonate, calcium carbonate, magnesium carbonate, calcium phosphate, talc, bentonite, diatomaceous earth, clay and the like. Usable catalysts are mainly those insoluble by water and easily soluble by monomers, with highly active catalysts such as benzoyl peroxide and 2,2-azobisisobutyronitrile well suited. The polymerization mechanism is simple compared to emulsion polymerization, being essentially the same as bulk polymerization, with the speed format also identical for both. However, in the case of bulk polymerization, the polymerization reaction does not proceed uniformly due to a rise in viscosity of the entire system and internal reaction heat, making temperature adjustment difficult. By contrast, in suspension polymerization, heat can be easily removed by the catalyst, making it suitable for industrial polymerization reaction, and there are no difficulties involving



mixing. However, as shown in the following table, a polymer with as high a degree of polymerization as in emulsion polymerization is not obtainable. Vinyl chloride, styrene, methyl methacrylate are polymerized by this method.

Comparison of polymerization methods

Type of Polymerization	Polymerization method	Catalyst	Temperature control	Polymerization speed	Polymerization degree	Polymerization shape
Bulk polymerization	Monomer only	Monomer dissolvable	Extremely difficult	Large	Large	Lump shaped
Solution polymerization	Monomer + catalyst	Solvent dissolvable	Difficult	Small	Small	Paste shaped
Emulsion polymerization	Water + emulsifier + monomer	Dissolvable in water	Easy	Extremely large	Extremely large	Latex shaped
Suspension polymerization	Water + monomer	Monomer dissolvable	Easy	Large	Large	Pearl shaped

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